

## Preface

*Large Antennas of the Deep Space Network* traces the development of the antennas of NASA's Deep Space Network (DSN) from the network's inception in 1958 to the present. This monograph deals primarily with the radio-frequency design and performance of the DSN antennas and associated front-end equipment. It describes all the new designs and technological innovations introduced throughout the evolution of the DSN. There is also a thorough treatment of all the analytical and measurement techniques used in design and performance assessment.

This monograph is meant to serve as an introduction to newcomers in the field as well as a reference for the advanced practitioner. The technical terms in the text assume that the reader is familiar with basic engineering and mathematical concepts as well as material typically found in a senior-level course in electromagnetics.

Portions of this monograph (in Chapters 2 through 6) were originally written in 1990 to be a chapter in a proposed update to Joseph H. Yuen's book, *Deep Space Telecommunications Systems Engineering* (published in 1983 by Plenum Press). However, the update was never completed, and some of the material was subsequently published elsewhere. After the formation at the Jet Propulsion Laboratory (JPL) of the Deep-Space Communications and Navigation Systems Center of Excellence, a decision was made to publish a monograph series to capture the fundamental principles and practices developed during decades of deep-space exploration at JPL. Since the many technological innovations implemented in the DSN antennas helped make significant improvements in deep-space telecommunications over the decades, there was a real desire to capture these contributions in a comprehensive reference.

Chapters 2 through 6 originally covered the antennas that existed in the DSN prior to 1990. These chapters have been updated to include additions since 1990, such as X-band uplink and Ka-band downlink on the 70-meter antenna. Chapters 7 through 9 cover the beam-waveguide antennas that were introduced during the 1990s. Chapter 10 discusses possible future directions for the DSN. Chapter 1, the last to be written, presents the mathematical principles used to design and analyze all the antennas. Chapter 1 also includes a section on the design of beam-waveguide antennas as well as the measurement techniques used to assess antenna performance.

The content of this monograph has been drawn primarily from the work of JPL colleagues, past and present, who have supported the development of the DSN antennas. In many cases, the text merely serves as a summary, the complete story being told by in the works referenced at the end of each chapter.

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